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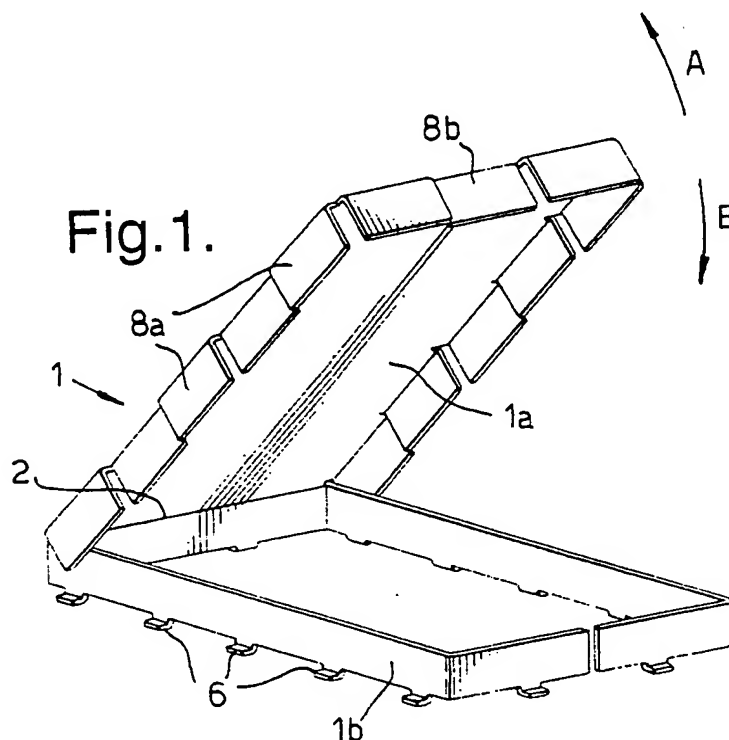
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(54) A shielding device

(57) An EMI/RFI shield with side walls and a hinged lid.



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## Description

This invention relates to a shielding device for use in radio telephones, preferably for the shielding of electronic components on a circuit board.

Radio telephones are required by law to adhere to ElectroMagnetic Compatibility (EMC) limits as laid down in Type Approval Specifications for Mobile Phones. EMC is defined as the ability of a device to function properly in its intended electromagnetic environment and not to be a source of electromagnetic pollution to that environment.

To enable electronic apparatus to be electromagnetically compatible, electromagnetic (EM) shielding is often placed within the apparatus to reduce the radiation emissions from radiating sources and to reduce the levels of radiation reaching sensitive components.

In general, EM shields take the form of metal or metallised plastic covers designed to be placed over electronic components on a circuit board. To prevent the passage of radiation towards or away from the electronic components the shields are electrically grounded, typically using the grounding planes present on the circuit board. The most common way of attaching the shields to the circuit board and particularly to the grounding planes is by soldering. This provides a semi-permanent fixing that may only be removed by de-soldering.

Ordinarily, during the production of radio telephones the electronic components are firstly mounted onto the circuit board. EM shields are then placed over the components and secured using soldering techniques that may also provide electrical coupling to ground. The circuit board supporting the electronic components and the shield can then be tested. A percentage of circuit boards inevitably fail the tests and inspection and repair of the electronic components is usually required. Similarly, units which pass the tests and subsequently become faulty for any reason may also require inspection and repair.

Current soldered shield designs have a disadvantage in that the inspection and repair of soldered electronic components is blocked by the presence of the EM shield casings. To inspect and repair the electronic components the shields must be de-soldered, the inspection and repair carried out and then the shields must be re-soldered. De-soldering and re-soldering is laborious and creates a risk of damage to electronic components within the region of the shield.

Other known shielding devices such as US 4,890,199 have the EM shield casing attached to the circuit board using one or more gaskets which allow removal of the shield casing during repair. These gaskets are, however, generally complex in structure and have to be mounted individually onto the circuit board during construction of the shield. Consequently manufacturing cost and time are increased using this method.

According to the invention there is provided a shielding device, formed from a unitary planar member,

for inhibiting the passage of electromagnetic radiation to and/or from circuit elements disposed on a substrate, comprising a first portion adapted for mounting on a substrate surface, and a second portion displaceable relative to the first portion for allowing access to circuit elements disposed on the substrate surface.

A shielding device in accordance with the invention has the advantage that it is displaceable between an open and a closed position. Substantial electromagnetic shielding is provided in the closed position and access to circuit elements beneath the shield is provided in the open position. The action required to move the shielding device from the closed position to the open position does not involve de-soldering. Thus a simpler and less time-consuming solution is provided in circumstances where, for example, electronic components mounted on a circuit board beneath the shielding device require inspection and repair.

Another advantage given by a shielding device in accordance with the invention is that only one component, the unitary planar element, is required to make the shielding device. As a consequence a cheaper solution is obtained which requires less assembling time and is generally less complex.

A shielding device manufactured by folding a unitary planar member has a number of advantages over other designs that use, for example, casting techniques. Firstly this type of manufacture is ideally suited to mass production methods where speed, consistency and low running costs are required. Secondly the design and production of the shield device in accordance with the invention can be easily modified to make shields of different shapes or sizes.

In a preferred embodiment the second portion of the shielding device is a cover displaceable by movement about its connection with the first portion. An advantage of using this system is that the shield can be simply hinged open or closed.

The shielding device is preferably made from a metal or a metal alloy, suitably, for example, nickel silver. This material provides good EM shielding and is suitable for folding processes. Also this material has a high degree of resistance to corrosion.

In a preferred embodiment two portions of the shielding device are respectively a side wall member and a lid with depending flanges. The flanges help to improve the shielding provided when closed. Also the flanges can be biased so that they are forced against and grip sections of the lower portion. Projections disposed on the flanges produce increased forces at the contact points with the first section which results in a good electrical contact between the first and second portions for good EM shielding. Complementing recesses which engage with the projections may be included on the first section of the shielding device which gives a method of fastening closed the second section.

Additional strength is provided to the shield when the lid is closed by positioning adjacent flanges alter-

nately inside and outside of the side wall member.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagram of a shielding device in accordance with the invention in an open position;

Figure 2 is a diagram of the shielding device of figure 1 in accordance with the invention in a closed position;

Figure 3 is a diagram of a template for constructing the shielding device of figures 1 and 2;

Figure 4 is an exploded view of a shielding device mounted onto a substrate;

Figure 5 is a plan view and auxiliary projections of a shielding device in accordance with the invention; and

Figure 6 is a cross-sectional view of the edge of the shielding device of figure 5 in a closed position.

Referring to Figure 1 there is shown a shielding device 1 in accordance with the invention. The shielding device 1 comprises an upper portion 1a and a lower portion 1b interconnected along an edge 2. The edge 2 is formed such that it provides a hinge by which the upper portion 1a may achieve rotational motion relative to the lower portion 1b as shown by arrows A and B. The edge 2 may be continuous as shown in Figure 1 or it may be perforated as shown in Figure 5.

Upon moving the upper portion 1a in the direction of arrow B the shielding device 1 reaches the closed position as shown in Figure 2. In the closed position the shielding device 1 resembles a standard shield in the form of a box 3 for inhibiting the passage of EM radiation in which the lower portion provides side walls 4 and the upper portion a lid 5.

Referring also to Figure 3 there is shown a template 25 made of, for example, sheet metal, cut into a specific shape. By bending the planar sheet 25 along predetermined lines, the shielding device shown in Figures 1 and 2 may be constructed.

The shielding device 1 is designed to be mounted onto a substrate 20 as shown in an exploded view in Figure 4. For clarity Figure 4 shows the shielding device 1 being mounted whilst in the open position. It is likely, however, to be more suitable for the shielding device 1 to be mounted whilst in the closed position. In the embodiment shown the shielding device 1 is provided with feet 6 which may be used as soldering points for soldering the lower portion 1b onto a grounding plane 21 of the substrate 20. Another embodiment, shown in Figure 5, omits the use of feet which then allows the shielding device 1 to be mounted onto the substrate by, for exam-

ple, seam soldering the lower edge 7 to the grounding plane 21.

The lid 5 of the shielding device has flanges 8 which extend from its outer edges. These flanges 8 depend from the lid 5 so that they point generally downwards. Two types of flanges exist in the embodiments described, a first type 8a that fit over the outside of the side walls 4 and a second type 8b that fit inside the side walls 4 when the lid is closed as shown in Figures 2 and 5.

The flanges can be biased for contact with the side walls 4 so that the upper portion grips the lower portion in the closed position. This improves the electrical contact between the two portions. Additionally, by having flanges that are alternately positioned inside and outside of the side walls, extra stability is provided to the side walls and hence to the entire structure.

The surfaces of some of the flanges that contact the side walls are provided with dome shaped projections 9 which may be formed using a metal punch. In the fully closed position the projections 9 abut the contact surfaces of the side walls 4. The biasing action of the flanges helps the projections to maintain an increased force on the side walls thus providing a further gripping action and a good electrical contact between the upper and lower portions in the closed position.

Referring to Figure 5 the lower portion 1b includes apertures 10 cut out of the side walls. These apertures 10 are positioned to complement the projections 9. When the shielding device is in the fully closed position the projections are urged into the holes by the biasing of the flanges 8 as shown in Figure 6. Consequently the projections mate with the holes to retain the shielding device in the closed position.

To gain access to electrical components on the substrate surface 20 (not shown), the shielding device must be moved to the open position. This is achieved by moving the upper portion in the direction of arrow B as shown in Figure 1. The process of moving the upper portion may be performed by, for example, applying an upwards force on one of the flanges opposite the hinge. The lid 5 may be provided with an aperture or other means by which a tool can be used to lift it from the closed position.

The present invention includes any novel feature or combination of features disclosed herein either explicitly or any generalisation thereof irrespective of whether or not it relates to the claimed invention or mitigates any or all of the problems addressed.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.

## Claims

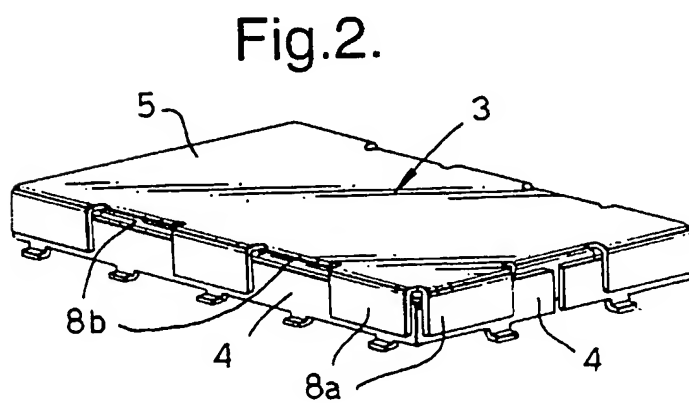
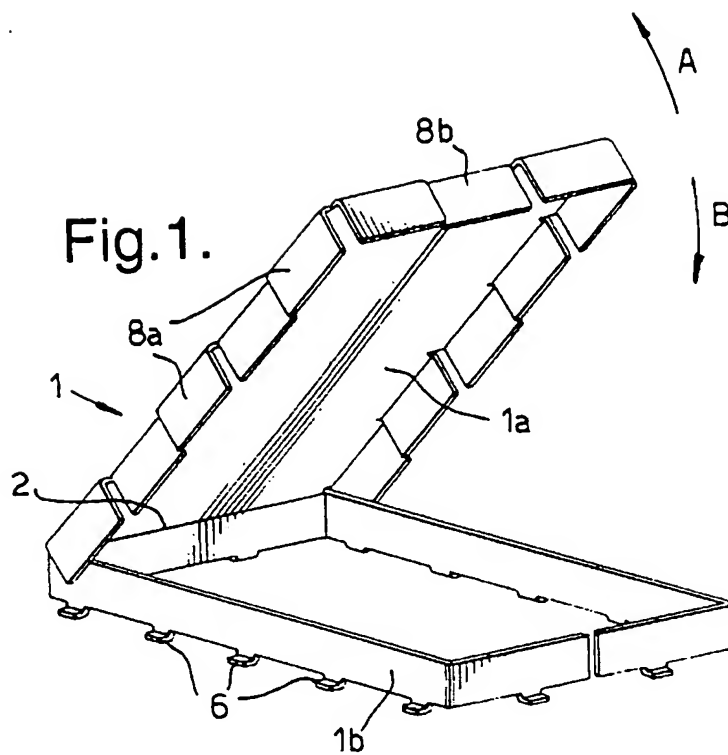
1. A shielding device, formed from a unitary planar member, for inhibiting the passage of electromagnetic radiation to and/or from circuit elements disposed on a substrate, comprising:

a first portion adapted for mounting on a substrate surface, and  
a second portion displaceable relative to the first portion for allowing access to circuit elements disposed on the substrate surface.

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2. A shielding device as claimed in claim 1, wherein the second portion is a cover displaceable by movement about its interconnection with the first portion. 10
3. A shielding device as claimed in claim 1 or claim 2, wherein the shielding device is configured as a box-like structure the first portion providing a side wall member and the second portion providing a lid movable between open and closed positions. 15
4. A shielding device as claimed in claim 3, wherein a plurality of flanges depend from the lid.
5. A shielding device as claimed in claim 4, wherein at least one of the flanges is arranged for disposition outside the side wall member in the closed position. 20
6. A shielding device as claimed in claim 4 or claim 5, wherein at least one of the flanges is arranged for disposition inside the side wall member in the closed position. 25
7. A shielding device according to claim 5 or claim 6, wherein at least one of the flanges is biased for contact with the side wall member in the closed position. 30
8. A shielding device as claimed in any of claims 4 to 7, wherein at least one of the plurality of flanges includes a projection extending towards a contact surface of the side wall member in the closed position for improving electrical conduction between the lid and the side wall member of the shielding device. 35 40
9. A shielding device as claimed in claim 8, wherein the side wall member comprises a recess for accommodating at least one of the projections on the flanges in the closed position. 45
10. A shielding device as claimed in claim 9, wherein the recess is an aperture.
11. A shielding device as claimed in any preceding claim, wherein the shielding device is made from a metal or a metal alloy. 50

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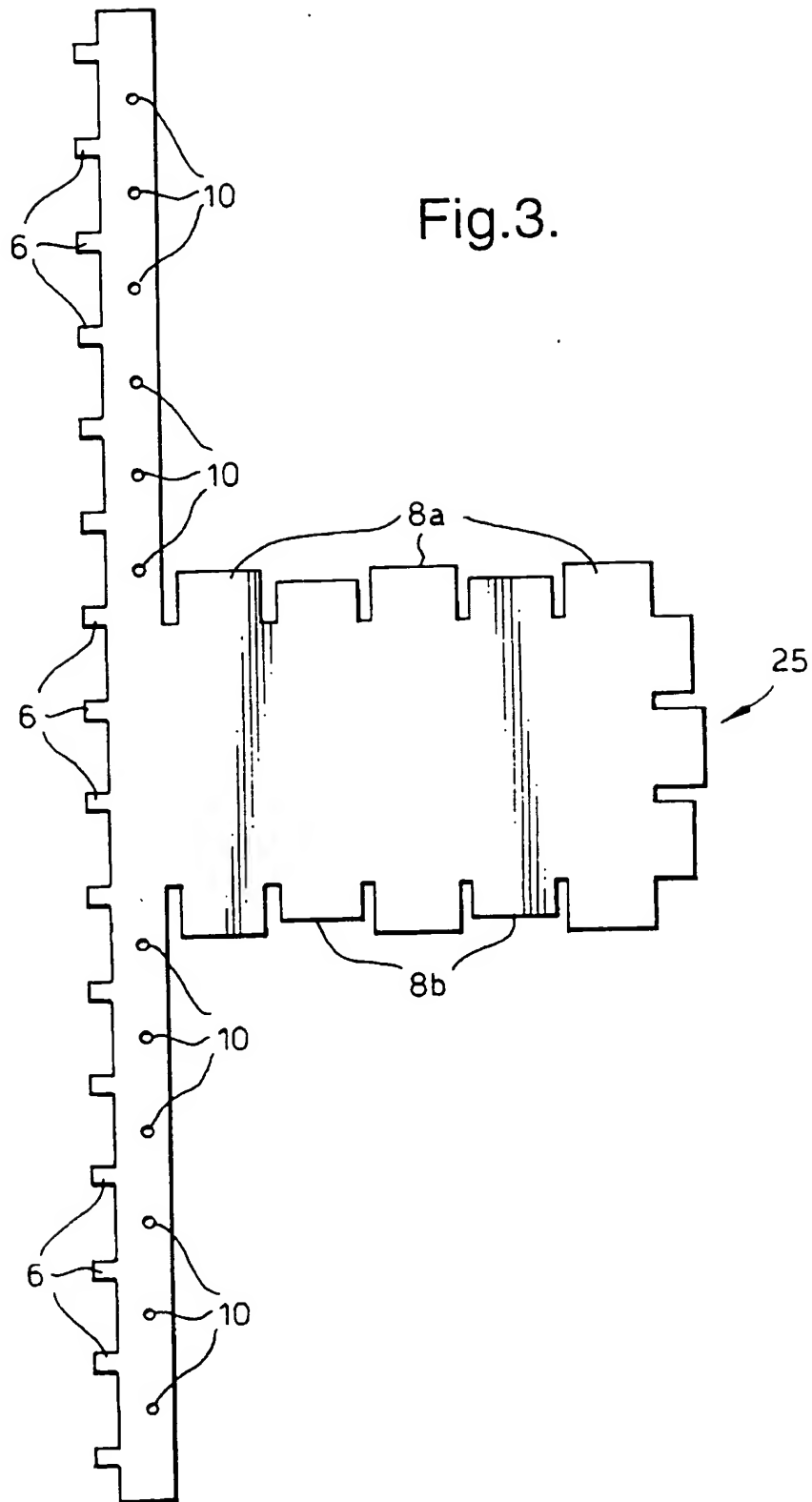


Fig.4.

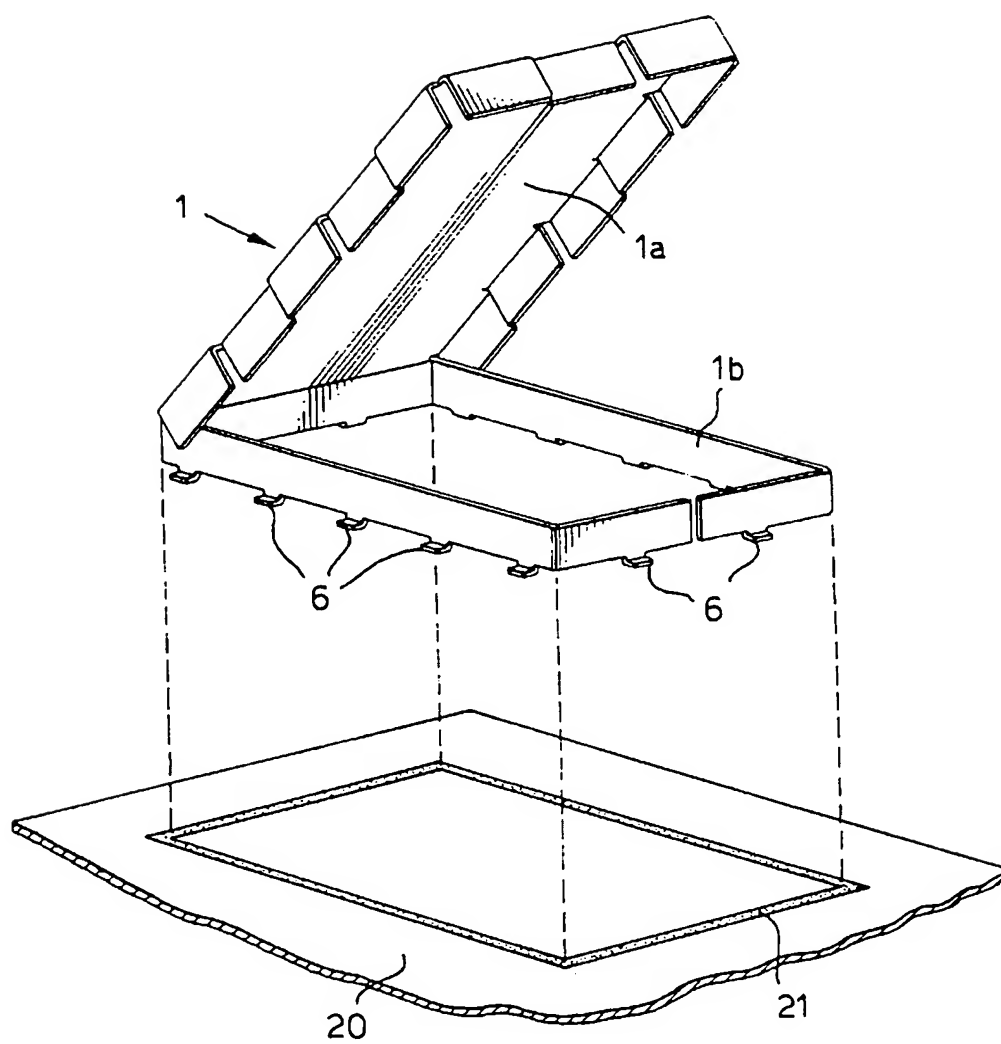


Fig.5.

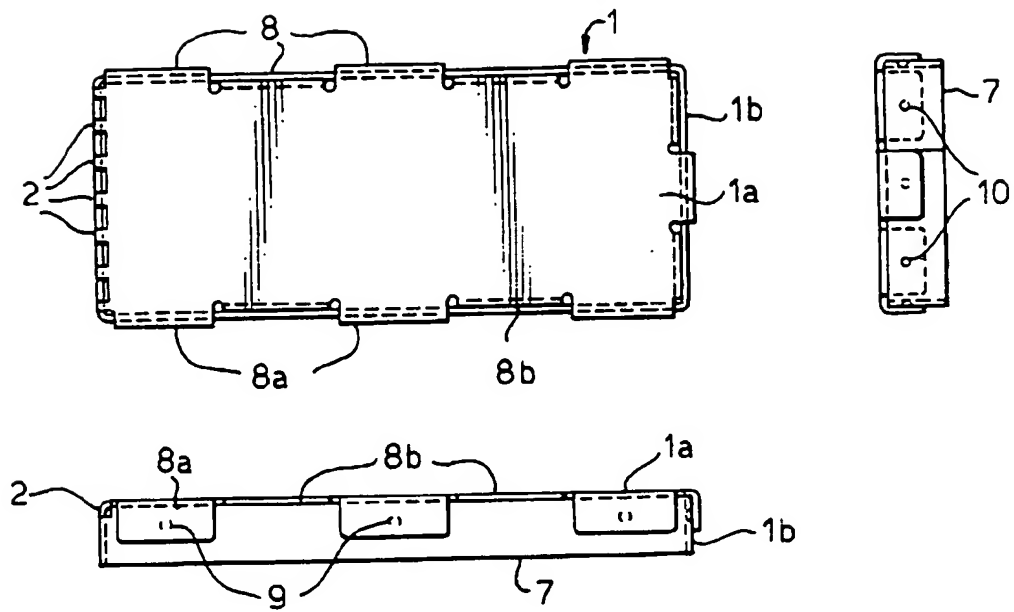
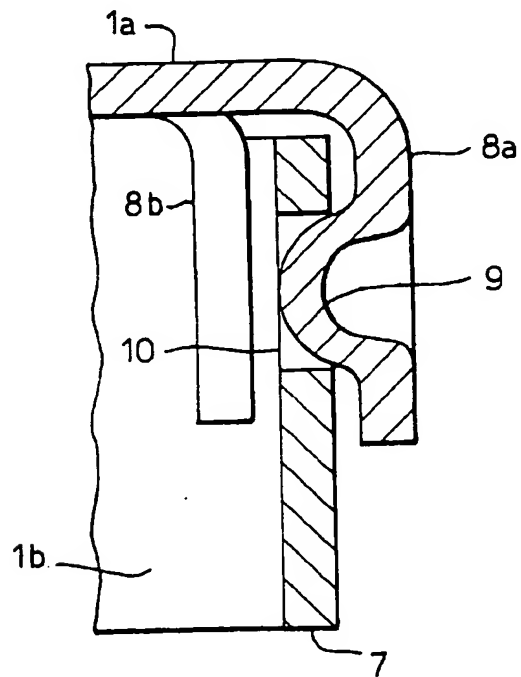


Fig.6.







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# EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 0392

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	DE-A-33 25 360 (PHILIPS PATENTVERWALTUNG GMBH)	1,2,11	H05K9/00
A	* the whole document *	3	
Y	US-A-5 354 951 (LANGE SR ET AL.)	1,2,11	
A,D	US-A-4 890 199 (BEUTLER)	1	
	* the whole document *		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H05K
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		21 May 1996	Toussaint, F
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